Universe

Jet Propulsion Laboratory

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Aura launches skyward

By Alan Buis

Aura, a mission dedicated to the health of Earth's atmosphere, successfully launched July 15 at 3:01:59 a.m. Pacific Time from the Western Range of Vandenberg Air Force Base, Calif., aboard a Boeing Delta II rocket. Spacecraft separation occurred at 4:06 a.m. Pacific Time, inserting Aura into a 705-kilometer (438-mile) orbit.

NASA's latest Earth-observing satellite, Aura will help us understand and protect the air we breathe.

NASA's Goddard Space Flight Center manages the Aura mission. The satellite's four instruments are the Microwave Limb Sounder, Tropospheric Emission Spectrometer, High Resolution Dynamics Limb Sounder and the Ozone Monitoring Instrument. JPL developed and manages the Microwave Limb Sounder and Tropospheric Emission Spectrometer. The High Resolution Dynamics Limb Sounder was built by the United Kingdom and the United States. The Ozone Monitoring Instrument was built by the Netherlands and Finland in collaboration with NASA.

"This moment marks a tremendous achievement for the NASA family and our international partners," said NASA associate administrator for Earth science Dr. Ghassem Asrar. "We look forward to the Aura satellite offering us historic insight into the tough issues of global air quality, ozone recovery and climate change.

"This mission advances NASA's exploration of Earth and will also better our understanding of our neighbors in the planetary system," he added. "Aura joins its siblings—Terra, Aqua and 10 more research satellites developed and launched by NASA during the past decade—to study our home planet."

"Many people have worked very hard to reach this point and the entire team is very excited," said Goddard's Rick Pickering, the Aura project manager.

With the launch of Aura, the first series of NASA's Earth Observing System satellites is complete. The other satellites are Terra, which monitors land, and Aqua, which observes Earth's water cycle.

Aura will help answer three key scientific questions: Is Earth's protective ozone layer recovering? What are the processes controlling air quality? How is Earth's climate changing? NASA expects early scientific data from Aura within 30 to 90 days.

Aura will also help scientists understand how the composition of the atmosphere affects and responds to Earth's changing climate. The results from this mission will help scientists better understand the processes that connect local and global air quality.

Each of Aura's four instruments is designed to survey different aspects of Earth's atmosphere. Aura will survey the atmosphere from the troposphere, where humans live, through the stratosphere, where the ozone layer resides and protects life on Earth.

The Microwave Limb Sounder is intended to improve our understanding of ozone in Earth's stratosphere, which is vital in protecting us from solar ultraviolet radiation. The Tropospheric Emission Spectrometer is an infrared sensor designed to study Earth's troposphere and to look at ozone and other urban pollutants.

NASA's Earth Science Enterprise is dedicated to understanding Earth as an integrated system and applying Earth system science to improve prediction of climate, weather and natural hazards using the unique vantage point of space.

For Aura information and images, visit *http://www.gsfc.nasa.gov/topstory/2004/0517aura.html* and *http://www.nasa.gov/aura.*

For more information about the Microwave Limb Sounder, visit *http://mls.jpl.nasa.gov.*

Photo courtesy of Goleta Air & Space Museum

The Aura satellite is shown following its launch from Vandenberg Air Force Base.

Mars rovers roll into Martian winter

By Whitney Clavin

As winter approaches on Mars, JPL's Opportunity rover continues to inch deeper into the stadium-sized crater dubbed "Endurance." On the other side of the planet, the Spirit rover found an intriguing patch of rock outcrop while preparing to climb up the "Columbia Hills" backward. This unusual approach to driving is part of a creative plan to accommodate Spirit's aging front wheel.

Spirit, with an odometer reading of more than 3.5 kilometers (2.2 miles), has already traveled six times its designed capacity. Its right front wheel has been experiencing increased internal resistance, and recent efforts to mitigate the problem by redistributing the wheel's lubricant through rest and heating have been only partially successful.

To cope with the condition, rover planners have devised a roundabout strategy. They will drive the rover backward on five wheels, rotating the sixth wheel only sparingly to ensure its availability for demanding terrain. "Driving may take us a little bit longer because it is like dragging an anchor," said Joe Melko, a rover engineer at JPL. "However, this approach will allow us to continue doing science much longer than we ever thought possible."

On Thursday, July 15, Spirit successfully drove 8 meters (26 feet) north along the base of the Columbia Hills backward, dragging its faulty wheel. The wheel was activated about 10 percent of the time to surmount obstacles and to pull the rover out of trenches dug by the immobile wheel.

Along the way, Spirit drove over what scientists had been hoping to find in the hills—a slab of rock outcrop that may represent some of the oldest rocks observed in the mission so far. Spirit will continue to drive north, where it likely will encounter more outcrop. Ultimately, the rover will drive east and hike up the hills backward using all six wheels.

"A few months ago, we weren't sure if we'd make it to the hills, and now here we are preparing to drive up into them," said Dr. Matt Golombek, a rover science-team member from JPL. "It's very exciting."

For the past month, the Spirit rover has been parked near several hematite-containing rocks, including "Pot of Gold," conducting science studies and undergoing a long-distance "tuneup" for its right front wheel.

Driving with the wheel disabled means that corrections might have to be made to the rover's steering if it veers off its planned path. This limits Spirit's accuracy, but rover planners working at JPL's rover test facility have come up with some creative commands that allow the rover to auto-correct itself to a limited degree.

As Spirit prepares to climb upward, Opportunity is rolling downward. Probing increasingly deep layers of bedrock lining the walls of Endurance Crater at Meridiani Planum, the rover has observed a puzzling increase in the amount of chlorine. Data from Opportunity's alpha particle X-ray spectrometer show that chlorine is the only element that dramatically rises with deepening layers, leaving scientists to wonder how it got there. "We do not know yet which element is bound to the chlorine," said Dr. Jutta Zipfel, a rover science-team member from the Max Planck Institute for Chemistry, Mainz, Germany.

Opportunity will roll down even farther into the crater in the next few days to see if this trend continues. It also will investigate a row of sharp, teeth-like features dubbed "Razorback," which may have formed when fluid flowed through cracks, depositing hard minerals. Scientists hope the new data will help put together the pieces of Meridiani's mysterious and watery past. "Razorback may tell us more about the history of water at Endurance Crater," said Dr. Jack Farmer, a rover science-team member from Arizona State University.

Rover planners are also preparing for the coming Martian winter, which peaks in mid-September. Dwindling daily sunshine means the rovers will have less solar power and take longer to recharge. Periods of rest and "deep sleep" will allow the rovers to keep working through the winter at lower activity levels. Orienting the rovers' solar panels toward the north will also elevate power supplies. "The rovers might work a little bit more every day, or a little bit more every other day. We will see how things go and remain flexible," said Jim Erickson, project manager for the Mars Exploration Rover mission at JPL.

For images and additional information, log on to *http://marsrovers.jpl.nasa.gov* and *http://athena.cornell.edu.*

News Briefs

MER team honored by NASA

Earlier this month, NASA honored teams of agency researchers—and their industry and university partners—whose work in safe and affordable air transportation, growth in critical national industries, enhanced national security, and scientific exploration and discovery has contributed to society.

One of the Turning Goals into Reality Awards went to the Advanced Information Technology Infusion Team for the Mars Exploration Rover mission.

The team received the Administrator's Award, which cited MER as NASA's most complex planetary rover mission to date. The citation noted: "At JPL's MER mission control, 240 scientists and engineers collaborated daily in shifts around the clock to navigate twin rovers across the rocky Martian terrain. In collaboration with JPL mission managers and personnel, NASA Ames Research Center developed automated planning and scheduling, information management and data visualization tools for MER and provided work practice studies to help engineering and science teams better meet the telerobotic mission's technical and logistical challenges."

Besides JPL and Ames, the Advanced Information Technology Infusion Team included staff from QSS Group Inc., the Research Institute for Advanced Computer Science, Alertness Solutions, Science Applications International Corp., Deanza College, Computer Sciences Corp., San Jose State University, Raytheon, Kestrel Institute, the Office of Naval Research and Wright State University.

"Over the past 45 years, NASA's research and technology developments have transformed our society. [We celebrate] the year's most significant accomplishments that add to this NASA legacy. We are honoring these teams of women and men, along with their industry and university partners, for their contributions," said DR. J. VICTOR LEBACQZ, associate administrator for aeronautics. "Now NASA itself is transforming. The technologies recognized, and the people behind them, strengthen our capability to achieve the Vision for Space Exploration."

A total of 17 teams were honored for accomplishments in aeronautics technology, Space Launch Initiative, mission science measurement technology, innovative technology transfer partnerships and agency education outreach goals. In addition, special awards were bestowed to the Investigation Organizer Team that supported the work of the Columbia Accident Investigation Board.

A complete list of the winning teams, with synopses of their accomplishments, is available at *http://www.nasa.gov/pdf/62333main_tgir_awards.pdf.*

For more information about the 2004 Turning Goals into Reality awards, see *http://www.aeronautics.nasa.gov/events/tgir/2004/index.htm.*

New job search tool now online

JPL Jobs!, the internal job seeker's online job search, posting and application tool, is now available. You can use JPL Jobs! to create an online career profile, upload your resume, search for open positions and apply online, and create a "job search agent" to notify you about new opportunities that match your job search criteria.

In addition, the new application eliminates the need to complete and submit a hard copy of the Employment Opportunity Application to Staffing when applying to a posted employment requisition. Employees are encouraged to complete internal applications online; however, Staffing will accept paper forms during a transitionary period.

Employees access JPL Jobs! from their NBS Toolkit. Those using PCs may access JPL Jobs! by using Internet Explorer versions 5.5 and 6.0 or Netscape Navigator version 4.7 and 7.0. Employees using Macintosh can access JPL Jobs! using Internet Explorer running under a PC emulator like Virtual PC. Macintosh users who choose not to use a PC emulator may use the existing job posting website at *http://hr/staffing/jobs.html* and continue to use the paper application process to initiate an internal job application. Staffing says Macintosh compatibility is their vendor's top priority for their next software release.

Managers who currently have access to Employ! will continue to access their Manager Toolkit, where they will find an additional tab from which they can conduct a job search, review a posted position and initiate the internal application process.

Employees have received a mailer containing a "Quick Guide" brochure to help navigate through the system. In addition, 30-minute briefings have been scheduled for Aug. 2 and 3 at 3 p.m. in von Kármán Auditorium.

For more information, call Staffing at ext. 4-5150.ext. 4-5150.

Blood drive coming up

The next JPL/Red Cross blood drive will be held in von Kármán Auditorium on Tuesday, Aug. 17, from 10 a.m. to 4 p.m. and Wednesday, Aug. 18, from 7 a.m. to 1 p.m.

To sign up, visit *http://www.givelife.org/index.cfm?hcl=JPL.* Use only work information and do not provide personal demographic information. Once you select your appointment, you will receive an automatic confirmation e-mail. Call the Red Cross at (213) 400-0140 if you need further assistance.

Advance signup sheets will also be available at JPL Occupational Health Services, Building 310-202, prior to the blood drive. For last-minute signups, or to change your appointment, call the Red Cross at (626) 960-6956, ext. 225.

To donate blood you must be at least 17 years old, weigh at least 110 pounds and be in good health.

For more information, visit *http://www.redcross.org/services/biomed/blood/supply/tse.html.*

Plan for FY '04 costing

With the fiscal year end coming up at the end of September, JPL's Finance and Contract Management Division reminds staff that it is time to address costing of procurements and travel that were budgeted in fiscal year 2004.

A detailed interoffice memorandum titled "Fiscal Year-End 2004 Costing and Accrual Practices," located on the Finance and Contract Management Division website at *http://fcmd/MEMO/FY2004Year-EndMemo.pdf,* provides answers to the following questions:

- When does a procurement get charged (costed) to a project/task?
- What is an accrual and how is it different from a cost?
- What procurements are accrued at month-end and year-end?
- What types of procurements are not accrued monthly or at year-end?
- What are special or ad hoc year-end accruals?
- What is the last day I can procure something and have the cost recognized on my project/task?
- What is the last day I can do a Purchase Requisition and have the cost charged to my project?
- What is the last day I can turn in a Travel Expense Report and have it included in this year's cost?
- What can the requisitioner do to expedite the costing of procurements?
- What will the Finance and Contract Management Division and Acquisition Division do to ensure costs are included in FY 2004?

Further questions? Contact one of the individuals listed on Page 5 of the memorandum.

NASA TV improves signal

NASA Television has improved coverage to viewers in Alaska and Hawaii as well as the continental United States with a switch of its signal from one satellite to two different ones.

NASA TV is now seen in the continental United States on AMC-6, at 72 degrees west longitude, Transponder 9, 3880 MHz, vertical polarization, audio at 6.8 MHz. For viewers in Alaska or Hawaii, NASA TV will now be seen on AMC-7, at 137 degrees west longitude, Transponder 18, at 4060 MHz, vertical polarization, audio at 6.8 MHz.

This satellite change is not associated with NASA TV's transformation to a digital format, scheduled for sometime in the next 12 months.

NASA TV also provides live webcasts. Log on to *http://www.nasa.gov/multimedia/nasatv/index.html.*

Special Events Calendar

Ongoing Support Groups

Alcoholics Anonymous—Meetings are available. Call the Employee Assistance Program at ext. 4-3680 for time and location.

Caregivers Support Group—Meets the first Thursday of the month at noon in Building 167-111 (the Wellness Place). For more information, call the Employee Assistance Program at ext. 4-3680.

Codependents Anonymous—Meeting at noon every Wednesday. Call Occupational Health Services at ext. 4-3319.

Gay, Lesbian and Bisexual Group—Meets the first Friday and third Thursday of the month at noon in Building 111-117. Call the Employee Assistance Program at ext. 4-3680 or Randy Herrera at ext. 3-0664.

Parents Group for Children With Special Needs—Meets the second Thursday of the month at noon in Building 167-111 (the Wellness Place).

Working Parents Support Group—Meets the third Thursday of the month at noon in Building 167-111. For more information, call the Employee Assistance Program at ext. 4-3680.

Tuesday, August 3

JPL Gamers Club—Meeting at noon in Building 301-227.

JPL Genealogy Club—Meeting at noon in Building 301-271.

Wednesday, August 4

Associated Retirees of JPL/Caltech—Meeting at 10 a.m. at La Cañada United Methodist Church, 104 Berkshire Place, La Cañada.

JPL Library Orientation—Come to Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

Thursday, August 5

JPL Gun Club—Meeting at noon in Building 183-328.

"Model-Driven Design With UML 2.0"—At 11:30 a.m. in conference room 180-101, author and software-development expert Dr. Bruce Douglass will discuss the forthcoming Unified Modeling Language specification, which enhances the ability of the user to model for larger and more complex systems. UML 2.0 has added explicit notions of architectural structure and improved the ability to decompose complex systems. The talk is presented by the Center for Space Mission Architecture and Design.

Mon.–Tues., August 9–10

Investment Advice—TIAA/CREF will offer one-on-one counseling. For an appointment, visit *http://www.tiaacref.org* or call (877) 209-3140, ext. 2614.

Tuesday, August 10

JPL Stamp Club—Meeting at noon in Building 183-328.

Wednesday, August 11

JPL Amateur Radio Club—Meeting at noon in Building 238-543.

JPL Library Orientation—Come to Building 111-104 at 11:30 a.m. for an overview of the Library's products and services, and learn how to access numerous electronic resources from your desktop. For more information, call the reference desk, ext. 4-4200.

JPL Toastmasters Club—Meeting at 5 p.m. in the 167 conference room. Call Debbi Llata at ext. 4-8374 for information.

Thursday, August 12

Clogging Class—Meeting at noon in Building 300-217. For more information, call Shary DeVore at ext. 4-1024.

Thu.–Fri., August 19–20

Von Kármán Lecture Series—Orbiting Carbon Observatory deputy principal investigator Charles Miller will present "Understanding Atmospheric CO_2 and its Impact on Climate Change" at 7 p.m. Thursday in von Kármán Auditorium and Friday in Pasadena City College's Vosloh Forum, 1570 E. Colorado Blvd. Thursday's lecture will be webcast at *http://www.jpl.nasa.gov/events/lectures/aug04.cfm.* For more information, call Public Services at ext. 4-0112.

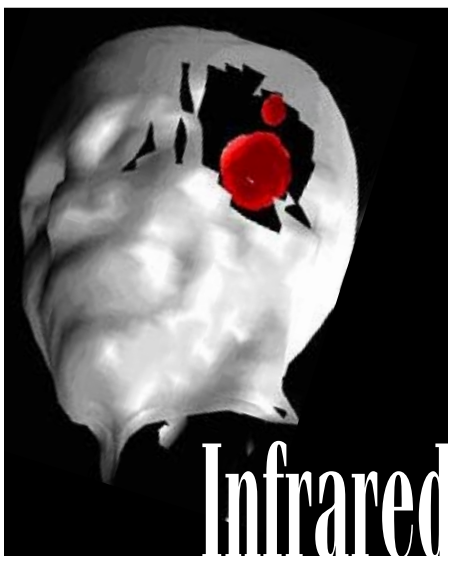
CloudSat radar on the move

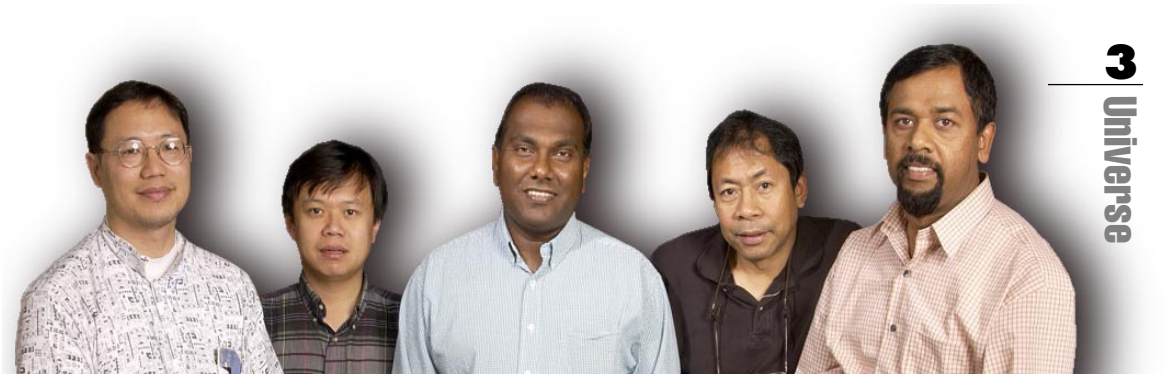
Photo courtesy of Steve Greenberg and Debra Higuera

The CloudSat satellite's Cloud Profiling Radar is shown being prepared for shipment on July 14 from JPL to industrial partner Ball Aerospace & Technologies Corp. The flight instrument arrived at Ball two days later. The instrument's post-shipment functional and performance verification was completed on July 20 and mechanical integration between the instrument and the CloudSat spacecraft bus was successfully completed on July 21.

CloudSat, part of NASA's Earth System Science Pathfinder program, is a mission to study the effects of clouds on climate and weather. The mission will use radar to measure the vertical structure of clouds and cloud properties from space. CloudSat is a partnership between JPL, Colorado State University, the Canadian Space Agency, the U.S. Air Force and the U.S. Department of Energy. Ball Aerospace is building the spacecraft.

Launch is planned for April 2005 from Vandenberg Air Force Base in California.





JPL's Infrared Focal Plane Array Technology Group developed the infrared camera. From left: John Liu, Ricky Chuang, Sarath Gunapala, Don Rafol and Sumith Bandara.

Infrared camera helps surgeons map brain tumors

By Natalie Godwin

Using an infrared video camera developed by scientists at JPL, surgeons are testing thermal imaging and image processing to see if they can create useful maps of brain tumors.

Researchers want to see if the camera, which detects infrared—or heat—emissions, might help neurosurgeons better visualize tumors before they operate and also find tiny clusters of cancerous cells that might remain after surgery.

NASA scientists already use infrared technology to map Earth's surface and search for distant objects in the universe. Firefighters use it to locate people trapped in buildings, and military forces track down their targets hiding in the dark.

Physicians have used infrared technology for mapping the roots of skin cancer, but it's never been used for brain tumors until now.

Doctors at USC's Keck School of Medicine are using the JPL-developed camera and infrared imaging in a trial. They're trying to see if they can sketch tumor margins by detecting temperature changes during surgery, since tumor cells emit more heat than healthy ones. "The camera's precision allows it to map temperature differences of one-hundredth of a degree Celsius at a high resolution," said Dr. Sarath Gunapala, supervisor of the Infrared Focal Planes and Photonics Technology Group in Section 384 and lead engineer for the camera.

Currently, neurosurgeons delve carefully into the brain and remove as much of the tumor as they can see under magnification. However, they may take healthy tissue along with the cancerous cells or leave residual cells that can grow back along the tumor's margins.

"Brain tumor tissue looks the same as healthy tissue on the edges," said Babak Kateb of the Keck School of Medicine, a research fellow and lead scientist of the project. "Tumor cells use different biochemical pathways from normal cells, and when researchers use the infrared camera, they can pick up hotspots or areas of tissue warmer than normal tissue," he added.

After doctors receive infrared images of the brain, imaging-processing software marks the boundaries between tumor regions and surrounding healthy tissue. "We are refining software similar to what our group has been using for analyzing rocks on Mars and other planets," said Dr. Wolfgang Fink, JPL senior researcher.

"An advantage of thermal imaging is that it's non-invasive," said Dr. Peter Gruen, a neurological surgeon at the Keck School of Medicine. "It measures heat energy emerging from patients without exposing them to X-rays or intravenous solutions, and is performed without incisions or contact to the brain tissue," he added.

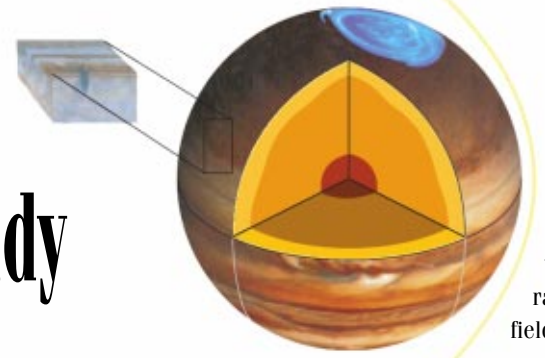
A clinical study of this proposed mapping process is underway at the Keck School of Medicine.

This is another example of the great benefits of transferring NASA-developed technology for the public good.

For more information on the USC study, log on to *http://www.usc.edu/keck.html.*

For more information on the infrared camera, visit *http://www.jpl.nasa.gov/technology/features/tech930.html.*

Lab proposal selected for New Frontiers Program study



The proposed Juno mission would orbit Jupiter from pole to pole.

NASA earlier this month announced the selection of two proposals for detailed study as candidates for the next mission in the agency's New Frontiers Program. One of the proposals—a mission that would orbit Jupiter from pole to pole for the first time to conduct an in-depth study of the giant planet—would be led by a JPL principal investigator with significant support from co-investigators and other staff.

Dr. Scott Bolton of the Astrophysics Element 3262 is named as principal investigator for the proposed "Juno" mission. This investigation proposes to use a highly instrumented spacecraft placed in a polar orbit about the planet Jupiter to investigate the existence of an ice-rock core, determine the global water and ammonia abundances in Jupiter's atmosphere, study convection and deep wind profiles in the atmosphere, investigate the origin of the Jovian magnetic field and explore the polar magnetosphere.

Juno's goal is to understand Jupiter's origin and evolution. "As the archetype of giant planets, Jupiter can provide the knowledge we need to understand our own solar system and the planetary systems being discovered around other stars," Bolton said. "Conventional theories for solar system origin and evolution do not explain the new planetary systems being discovered. New theories are being developed to accommodate the new observations of extrasolar planets, while still explaining the existence of our own system in which we live. The stakes are high, as systems like ours may be required to provide planets in which life can originate and evolve. How common are such systems?

"As our most massive planet and thus the one most similar to the even more massive extrasolar planets being discovered, Jupiter is clearly the critical piece in this puzzle," he added. "When, where and how Jupiter formed must have played a key role in the formation of the other planets, including Earth and the delivery of its endowment of volatiles."

Juno places a spinning spacecraft into an elliptical polar orbit around Jupiter for about one year. The orbit has a very close perijove, or the point in orbit closest to the planet (about 5,000 kilometers above the cloud tops), initially placed near Jupiter's equator. Juno carries precise, high-sensitivity microwave radiometers that are used to determine the deep global water (oxygen) and ammonia (nitrogen) abundance. The Galileo probe determined that Jupiter has about three times the amount of heavy elements (relative to hydrogen) than the sun. Unfortunately, Bolton said, Galileo did not measure the abundance of water. The amount of water in Jupiter is of interest because it discriminates among current theories of Jupiter's formation (water in the form of icy planetesimals is probably the carrier for Jupiter's enrichment of heavy elements). The icy planetesimals that mixed with the proto-solar nebula to form Jupiter are fundamentally important because they may have been the primary source of water to our solar system. The microwave radiometry also investigates how deep Jupiter's zones, belts and other atmospheric features go (this is the most basic question of Jovian atmospheric dynamics).

With its radio science system and magnetometers, Juno proposes to make high-accuracy maps of Jupiter's gravity and magnetic fields by exploring the internal structure, core mass and origin of the dynamo. These measurements tell us a great deal about how, where and when Jupiter formed. Juno also carries an extensive suite of in situ fields and particles experiments and remote sensing to provide the first in-depth investigation of Jupiter's polar magnetosphere and aurora.

Juno co-investigators from JPL are John Anderson (Section 331K), Samuel Gulkis (3220), Candice Hansen (3222), Michael Janssen (3265), Michael Klein (9020), Steven Levin (3265) and Edward Smith (3263). Bolton said other key JPL personnel on Juno include Sami Asmar (Section 331K), Mark Hofstadter (3220), Neil Murphy (3263), Glenn Orton (3222), Daniel Santos-Costa (4500) and Thomas Spilker (311B).

The second proposal chosen by NASA as a New Frontiers candidate is "Moonrise: Lunar South Pole–Aitken Basin Sample Return Mission," with Dr. Michael Duke of the Colorado School of Mines as principal investigator. This investigation proposes to land two identical landers on the surface near the moon's south pole and to return more than two kilograms (about five pounds) of lunar materials from a region of the moon's surface believed to harbor materials from the moon's mantle.

"These two outstanding proposals were judged to be the best science value among the seven submitted to NASA in 2004," said Dr. Ed Weiler, NASA's associate administrator for space science. "It was a very tough decision, but we're excited at the prospect of the discoveries either of them could make in continuing our mission of exploration of the solar system, and what they could tell us about our place in the universe," he added.

Following detailed mission concept studies, due for submission by March 2005, NASA intends to select one of the mission proposals for full development as the second New Frontiers mission by May 2005. The selected New Frontiers science mission must be ready for launch no later than June 30, 2010, within a mission cost cap of $700 million.

Each proposal will now receive up to $1.2 million to conduct a seven-month implementation feasibility study focused on cost, management and technical plans, including educational outreach and small business involvement.

The two selected proposals were submitted to NASA in February 2004, in response to the New Frontiers Program 2003 and Missions of Opportunity Announcement of Opportunity.

The New Frontiers Program is designed to provide opportunities to conduct several of the medium-class missions identified as the top priority objectives in the Decadal Solar System Exploration Survey, conducted by the Space Studies Board of the National Research Council.

NASA's New Horizons mission, which will fly by the Pluto-Charon system in 2014 and then target another Kuiper belt object, was designated the first New Frontiers mission.

Passings

DR. HERMAN THORMAN, 82, a retired aeronautics engineer, died Jan. 11.

Thorman joined JPL in 1956. He worked on the design of the Sergeant missile and designed instruments and propulsion systems for robotic moon missions, including Surveyor. He later worked in the Deep Space Network as test and training system engineer and command system engineer. He retired in 1987.

Thorman is survived by his wife, Dorothy, son Tom and daughter Susan.

Letters

On behalf of my family and myself, I want to thank my friends and co-workers at JPL for their expression of sympathy and support in the loss of my mother. We are deeply indebted to you all for your thoughtfulness and kind words and for the flowers and plants. I also want to thank the JPL Employee Services and Recognition Office for the lovely plant they sent to my home.

Phil Varghese

I would like to thank my friends and co-workers in Sections 348 and 3428 for their caring and support during the recent illness of my husband. It meant a great deal to both my husband and myself and knowing that my fellow group members were there for me eased my burden considerably.

Stephanie Cowans

On behalf of Jan and myself, thanks to all for your kind expressions of sympathy after the passing of my precious little sister, Jeanne. Thanks also to JPL for the beautiful plant.

Pat Beyer

We would like to convey our heartfelt thanks to all of our JPL co-workers for their prayers and support at the passing of our dearly loved mother and grandmother. The many beautiful flowers, plants and cards were greatly appreciated. Words seem inadequate when we try to express our gratitude for the kindnesses shown during this most difficult time.

Glenn Knosp and family
and Gail and Bill Robinson

I would like to sincerely express my thanks to everyone here at JPL for their sympathy and condolences on the recent death of my dear wife, Sally Ann Bennett. Sally was an avid science and science fiction buff and took a great deal of pleasure in our family's association with JPL. A special thanks to my co-workers for the beautiful flowers. They really meant a lot to us. Thanks so much again.

Johnny C. Bennett

Retirees

The following JPL employees retired in July:

Frank Stott, 31 years, Section 514; Carroll Winn, 30 years, Section 800; Frederick Mintz, 22 Years, Disability; Jacquie Clark, 21 years, Section 703; James Kimberling, 21 years, Section 5124; Edward Romana, 11 years, Section 701.

Classifieds

For Sale

AIR CONDITIONER, Whirlpool, room, 5900 BTU, model #ACM062, new $200, sell for $55. 714/280-7368.

BEDS: single, light wood, $100/obo; trundle, single (second bed rolls out from under), white metal, $100/obo; all with mattresses, gd. cond. 626/794-1133.

CANOE, Old Town, Katahdyn model, 16', burgundy, $500. 957-7742.

CLOTHES, infant: jacket, red/navy blue, zip-up w/hood (Old Navy), size 2T, exc. cond., $5/obo; sweater, sky blue w/navy trim, buttons, size 3T, $1/obo; zipper shoes, Spongebob motif, size 11M, exc. cond., $6/obo; photo of each item avail. 626/791-6101.

COFFEE TABLE, beautiful, round, 45" dia., solid dk brown wood, imported from China, carved design around perimeter, $285. 545-0455.

COMPUTER DESK, on wheels, cherry veneer, made by O'Sullivan, model 61925, exc. cond., like new; sell for best offer. 626/449-0997.

COMPUTER MONITOR, Phillips 19", works just fine, cables incl., $100. 310/489-8308, Peter.

COMPUTERS: Macintosh, G4 Dual 500 w/832 MB, 60 GB, internal Zip, Airport, Soundblaster, Radeon 8500, Mac OS 9/X Jaguar, $600; Blueberry G3 iBook 300 w/288 MB, 20 GB, Airport, 3 GB USB HD, Mac OS 9/X 10.1, no battery, http://haighworld.com/mac for pics/info, $300. 321-7461 or brian@ haighworld.com.

COUCH, 8 ft., beautiful white satin, elegant, clean, $295; matching 6-foot love seat, $265; free microwave with purchase of both pieces. 545-0455.

CURIO CABINET, rosewood, 5 shelves, beveled glass doors and sides, mirrored back, lighted, 2-shelf storage cupboard on bottom, 78" H x 38" W x 14" D, exc. cond., photos available, $275. 323/257-7928.

DODGER TICKETS, selected games from season ticket package, Loge level (orange), Aisle 132 (at 1st base), 2 tickets/game at face value of $30/ticket, see www.delunac.net/tickets for details and available games. 626/296-1253.

DRESSER, Queen Anne style w/mirror, $200; CHEST, $300; or $400 for both. 626/441-4940, ronak_1999@yahoo.com, Roy.

DRYER, gas, Kitchen Aid, ~6 yrs. old, gd. cond., $70. 626/798-6488.

FURNITURE: couch, 7', med. blue; love seat & chair, southwest décor; bar dinette set w/4 mauve padded stools; each set $100/obo. 626/794-1133.

FURNITURE for living/family rm.: curio cabinet, wood end/coffee table, 2 stiefel lamps, 8' couch, 2 chairs, 2 reclining loungers, kitchen table w/4 chairs, throw rugs, plant stands, good cond. 957-4770.

FURNITURE: ornately carved oak desk, 50" W x 24" D w/2 matching bookcases, 50" H x 25" W x 12" D, $500; Techline office furn., white, 6 pieces, $350; Spanish handmade rug 7' x 9', bright pink & orange, $200; tall wood-framed mirror, $25; mission oak server, 38 W x 20 D x 37 H, $300; 2 ceramic lamps, dusty rose, $30; 626/584-0860, day, 626/794-3144, eve, Donna.

FURNITURE, 'This End Up,' solid wood, 2-seater couch, armchair w/arm/table extension, ottoman, occasional table, retail $1,282, sell $500/obo. 626/303-3877, Margaret or Jim.

MISC: audio oscillator, $10; turkey roaster, covered, vg cond., 15 x 11 x 7 1/2, $7; covered porcelain vegetable dish w/handles, flower design, $9; glass coffee jug with handle, 2 qt., $5; 2 badminton racquets, like new, $4/ea.; covered aluminum cooking kettle, 5 qt., $8; electric dinner bun warmer, gd. cond., $7. 626/793-1895, Albert.

MISC: 8' pool table, $500; tablecloths (2), slate blue oval, 18 matching napkins and rings, $10; punch bowl set, 18 piece, $10; mailbox, oversized, green, $20; wig, red, shoulder length, never used; electric frying pan, $10; answering machine, $5; portable basketball set, needs net, $200; fishing pole, saltwater, $25. 626/357-8210.

MISC: sleeping bag for adult, roll-up, inside like new, $10; 2 standard bed pillows, non-allergenic, new, $5/ea.; blanket, pink, polyester, full size, new, $8; lifesaver boat cushion, $4; food chopper, hand operated, $8; 10" glass hr'drv dish w/handles, cut glass, $4; other items. 626/793-1895, Albert.

MISC: SBC light meter w/case, Luna Pro, $75; 2 Sima film shield bags, $5 ea; Nikon close-up filter, 6T, $25; Tiffen 81B filter, 62mm, $7; Tiffen Enhancing filter, $15; Hoya UV & Skylight, 1B, 62mm, $7 ea; T-mount adapter, Canon, $5; Saunders slide magnifier, $5; luggage, exc. cond., shoulder bag, $20; Wheel-a-board, 22" suitcase, red, $35. 626/355-4967.

MISC: Sony Walkman, Memorex Walkman, Sony am/fm/cass. Walkman, $15-20/ea.; Nokia 1260 w/case $35; Suunto Wristop computer, $250; diamond ring, $90; intercom system $40; lantern stand, $5; 2 small Coleman lanterns, $5/ea.; water purification system, $50. 897-1203, Valerie.

MOVED SALE: Torino table and 6 chairs in merlot from Z Gallerie, $800 (paid $1,470 in 1/03); treadmill, Pro-Form 585, accurate performance, $200; garage door opener, Genie, screw drive, model IS 550/A, $50; good twin mattress, $50; Sharp TV-VCR combo, 14", color, $50. 626/794-7972.

PHOTO EQUIPMENT: travel carrying case for photos ~36 x 30", $15; projection screen w/stand, ~ 40 x 40, $20; Gordon Wiltsie limited edition photos (2), framed, signed, Sunrise at Temple Crag, #1 of 250, Dueling Rattlesnakes, both $75/ea.; Litedisk, 42", white/white round reflector, $25; Starblitz, 160A flash, $5; 80-270 Tamron hardcase, $5; flash reflector, $3; Sunpak 422D flash, $25; Nikon HN-24 hood, $5. 626/355-4967.

PIANO by Hobart M Cable, small upright, exc. cond., buyer arranges pick-up in Simi Valley, $750/obo. 805/660-7446, Ben Bronwein.

SOFA SLEEPER, queen, + matching love seat, 4 years old, from Feddes store, muted green, exc. cond., professionally cleaned, $750 for pair. 626/351-7615, Anne.

SECTIONAL, approx. 9' x 7', needs re-upholstering, frame and cushions in gd. cond., $50. 626/850-4378.

SECTIONAL, 2-piece Bassett (1 piece is a sleeper), floral print, photo & dimensions available, cushions need new covers, rest in gd. cond., $300/obo. 626/791-6101.

THEATER TICKETS, 2, for Little Shop of Horrors, Ahmanson Theatre, Aug. 26, 8 p.m., seats in mezzanine, orig. $140 + fees for pair, sell $100. 790-8523.

THERAPY MACHINE, HYS-398, digital, used a few times, Chinese/Eng. user's manual, microcurrent for acupuncture, massage, manipulation, etc., $200/obo. 626/840-0955, leave msg.

WASHING MACHINE & DRYER, Maytag electric, older model, yellow, $50/ea. 626/850-4378.

WASTEBASKET, white, plastic w/metal guide rail, about 1 x 2 x 3 ft. tall, installs inside kitchen cabinets to hide trash, brand new, in orig. box with screws for installation, $80/obo. 626/840-0955, leave msg.

WATERBED floatation syst., w/foundation, Somma-type tubes, queen sz., $75. 626/447-6423.

Vehicles / Accessories

BATTERY, Optima 800U "Red Top," new with top and side terminals, it didn't fit the car I wanted to use it in, $75/obo. 249-1801 or veyron@access4less.net.

'98 BMW M3, 4 dr., 5 spd., 3.2L, 16 DOHC, 24-valve fuel-injected eng., sporty bright metallic blue, black leather int., ABS, power everything, a/c, am/fm/cass., 17" alloy wheels, sunroof, 98K mi., gd. cond., $17,500. 248-0869.

'98 BMW 323, 85K mi., black, auto, 2 dr., leather, sunroof, new brakepads and rear rotors, new rear tires, great condition, $10.9K. 310/614-5076.

'95 BUICK LeSabre, loaded, leather seats, 130K mi., runs great, $3,100. 626/447-6423.

'97 CHEVROLET Suburban, LS, V8, driver & passenger airbags, power everything, no accidents, flawless cond., vake3377@yahoo.com for pics, $11,000/obo. 846-0053.

'98 FORD Explorer XLT, 4WD, 57,777 mi., exc. cond., rear a/c, 6-CD player, more features, picture on www.cars.com, $8,888. 548-1312, Ray or melvanh@pacbell.net.

'98 FORD Explorer XLT, 100K mi., 5.0L V8, gd. cond., $6,000. 562/477-0063.

'96 FORD Explorer SUV, excellent condition, 69,000 miles, loaded, leather seats, 4WD, 6 cyl., auto, 6-deck CD, must see to appreciate, $7,995. 244-5489.

'90 FORD Bronco II XLT, 4 x 4, 97K mi., auto, a/c, cruise cont., pwr. steering/brakes/windows/ door locks, tinted windows, low restriction exhaust, looks nice, runs well, gd. tires, new smog cert., e-mail kiwixplant@adelphia.net for pictures, $1,600. 805/523-7782, after 6 p.m.

'99 GMC Yukon Denali, 76K mi., loaded, 4WD, leather, 6-CD changer, exc. cond., $16,000/obo. 800/937-9200, Levi or Cathy.

'01 HONDA CBR 929RR, 4K mi., bought brand new in '03, $6,700/obo. 661/251-1590.

'93 HONDA Del Sol, exc cond., auto, a/c, targa top, radio/tape, remote/alarm, pics at www.hotplasma.com/delsol.htm, $2,900/obo. 626/286-3037.

'88 HONDA Accord. 4 dr., auto. trans., a/c, power dr. lock, 87K mi., new cond., $2,500. 909/629-2891.

'98 LEXUS ES 300, premium sound system, loaded, 85K mi., $10,000. 645-2478.

'94 LEXUS LS 400, champagne, immaculate cond. inside & out, all service records available, leather in pristine condition, special chrome rims and wheels, new stereo, 157K mi., $8,400/obo. 468-0603, Walter Victor.

'90 LEXUS ES 250, exc. cond., 130K mi., $6,500/obo. 957-2421.

'95 MAZDA MPV LX van, dual a/c, CD changer, exc. cond., 138K mi., runs great, beige color, $3,800. 562/695-5197.

'97 MERCEDES BENZ 420, only 71K mi., exc. cond., loaded, black on black, $18,200. 406-2928.

TIRES (4), P285 60R16, $25/ea. 897-1203, Valerie.

Free

CLEAN FILL DIRT, 20 cu. yds. avail., haul as little or as much as you like, near Los Robles/Jackson, Pasadena. 626/791-3103, dtrask6@its.caltech.edu.

COMPOSTER, free-standing, tumbler-style, w/instructions; CARDBOARD BOXES, left over from moving. 610-8445, Harold or Torrie.

JACKETS, size 18, hardly worn: pink, Sag Harbor; navy, Radcliffe; soft floral on beige background, Radcliffe; all 3 have roll-up sleeves. 626/449-0997.

MISC: lg. wooden work bench, commercially fabricated, w/3 drawers & electrical hookups, 35" D x 66" W x 32" H, top shelf 17" D, 66" W; table saw, very old Craftsman, mounted on stand w/wheels; electric planer for wood, very old, mounted on stand w/wheels; drill press, old, lg., commercial, floor mounted, converted to 110V; air compressor, commercial, old, lg., gas engine, street tire mounted (trailer); countertop, lg., thick stainless steel mounted on plywood, 12" H back-splash, 24" D x 66" W. 626/794-0455.

TRAMPOLINE, 14' round, you pick up, close to Lab. 952-7940, Mickie.

Lost & Found

Found: Glasses, in 180-903. Ext. 4-3406, Donna.

Wanted

CARPOOLERS from La Verne area, hours 7 a.m. – 3:45 p.m. Ext. 3-2555, Dawn.

DRUM SET, 3 piece, with cymbals and stool, for beginner. 541-9091.

HOUSE RENTAL, somewhere between LAX, Santa Monica and JPL. 562/477-0063.

HOUSE / APT. RENTAL, 1 or 2 bd., for new JPL postdoc (working at Caltech) for initial 11 mo. from late Aug., prefer semi-furn. & close to transport. dlondish@hotmail.com, Diana.

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present, for personal use. 790-8523, Marc Rayman.

VANPOOL RIDERS from Victor Valley/Hesperia. Ext. 4-1424, Scott.

VOLLEYBALL PLAYERS, coed, no beginners please, Tues. nights 8 to 10 p.m. at Eagle Rock High School, $4/nt. 956-1744, Barbara.

WASHER/DRYER, stackable unit. 952-7940, Mickie.

For Rent

ALTADENA "sabbatical house," 3 bd., study, boundary Angeles Nat'l Forest, 3 mi./JPL (trails to Lab behind house), view, hardwood floors, antiques; completely furn. including dinnerware, utensils, pots/pans, bed linens + towels, fine soaps, necessities incl.; just bring toothbrush & clothes; TV/DVD/VHS, Dish satellite, wireless DSL; garden, fruit trees, BBQ, parking; priv., immaculate; month–month rent. 626/798-3235.

ARCADIA apt., 2 bd. + den, 1 ba., garage, remodeled kitchen, refrigerator/washer/dryer in unit, a/c, dishwasher; spacious, walking distance to shops, exc. neighborhood, no pets, water/gardener/trash included, $1,350 + utilities & security deposit. 626/576-7333.

LA CANADA house, 3 bd., 3 ba., detached garage, new addition w/gourmet kitchen, > 2,000 sq. ft., dishwasher, a/c, laundry hookups, fireplace, spacious family room, private yard with fruit trees, La Cañada schools, $3,000, water & gardener incl. 626/798-7276.

NORTH GLENDALE, 2 bd., 1 ba., duplex, hardwood floors, laundry, garage, extra parking, a/c, lg. bdrms, 819 N. Verdugo, $1,325. 726-1270.

N. GLENDALE townhouse, 2 bd., 2 1/2 ba., tile and wood floors, 2-car garage, avail. Sept. 1, lease, $2,050. 265-3855, Suraiya.

PASADENA, executive home in Upper Hastings Ranch, 3 bd., 2 ba., den, family room, newly remodeled kitchen and baths w/corian and granite countertops, washer/dryer, central a/c & heat, gardener incl., $2,950, lease required. 626/429-3677 or bettyrs@earthlink.net.

PASADENA, spacious very private rm. + priv. ba. in condo, prime location nr. Caltech, quiet, very clean, lg. closets, shared kitchen/liv. rm., lg. balcony/nice view (green trees), gated security garage, laundry in bldg., quiet male preferred, $530 + $35 util. 626/796-9221.

SAN MARINO home for lease, 3 bd., 1.5 ba., walking dist. to Carver Elementary and San Marino High, refrigerator, range, microwave (brand new), newly painted, cent. a/c + heat, alarm system, covered patio, 2-car attached garage, 1580 Bellwood Rd., $3,200, includes gardener, trash and water. 714/553-8585, Richard Tan.

SAN MARINO house, 3 bd., 2 ba., 2-car garage w/automatic opener, newly painted, remodeled kitchen, dishwasher, a/c, laundry hookups, fireplace, spacious family rm. overlooking yard, no pets, exc. neighborhood and school district, $3,200 + utilities & security deposit. 626/576-7333.

SYLMAR townhouse to share, spacious, 1 bd. with bath, close to 210 and 118 freeways, near shopping centers and restaurants, prefer male, non-smoker, no pets, asking $800. 365-2098.

TUJUNGA home, 3 bd., 2 ba., 2,000 sq. ft., 2-story, gorgeous, private, hillside, 2-car attached garage, large lot, lots of parking, stove, dishwasher, heating/cooling, fireplace, beautiful large yard and garden, washer/dryer hookups, will consider pet, $2,100 + $2,500 security, available Aug. 5, prefer lease, will consider month to month. 352-3840, Jim.

VAN NUYS house, 2 bd., 2 ba., den could be 3rd bd., pool, lg. rms., central air/heat, 2.5 garage, close to fwys, shopping and schools; $2,500 w/security deposit. 786-2289, 7–8 p.m., AJ Martinez.

Vacation Rentals

ARROWHEAD cabin, lake view, 6 max., $140/wkends., $350/wk., others available, security/cleaning deposit required. 818/952-6221, Mon.–Thur.; 909/337-1036, Fri.-Sun.

BIG BEAR LAKEFRONT luxury townhome, 2 decks, tennis, indoor pool/spa, beautiful master bd. suite, slps. 6. 949/786-6548.

CAMBRIA house, ocean front, exceptional white water view, accom. up to 4 people, all amenities provided. 702/256-1359 & ereynolds2@cox.net.

FLORIDA condo, New Smyrna Beach, fully furnished, 2 bd., 2 ba., full kitchen, half hour to Cape Canaveral, quiet, relaxing, overlooking beach; BBQ, pool, game room, great ocean view, easy walk to stores and restaurants, sleeps 6; avail. weekly or monthly. 760/439-7821, Darlene or dfhauge@yahoo.com.

HAWAII, Maui condo, NW coast, ocean front view, 25 ft. fr. surf, 1 bd. w/loft, compl. furn., phone, color TV, VCR, microwave, d/w, pool, priv. lanai, slps. 4, laundry fac., low season rate $115/nite/2, high season rate $130/ nite/2, $15/nite/add'l person. 949/348-8047 or jackandrandy@cox.net.

LAS VEGAS timeshare, 5-star resort, 7 nights, 1 bd., sleeps 4, must be 21 to register, Oct. 8–15, dates and location (Palm Springs, Tahoe, Utah, Dana Point, Ramona) can be changed. 626/447-4734.

MAMMOTH, Snowcreek, 2 bd., 2 ba., + loft, slps. 6–8, fully equip'd kitch. incl. microwave, D/W, cable TV, VCR, phone, balcony w/mtn. vw., Jacz., sauna, streams, fishponds, close to Mammoth Creek, JPL disc'nt. 626/ 798-9222, 626/794-0455 or valeriee@caltech.edu.

OCEANSIDE condo, on the sand, charming, 1 bd., panoramic view, walk to pier or harbor, pool/spa, game room, slps. 4. 949/786-6548.

ROSARITO BEACH condo, 2 bd., 2 ba., ocean view, pool, tennis, short walk to beach on priv. rd., 18-hole golf course 6 mi. away, priv. secure parking. 626/704-3906.

VANCOUVER, British Columbia, Metrotown, hotel voucher for 3 nights at the AAA, 4-diamond Hilton, next to BC's largest shopping/ent. center, only 1 block from Skytrain station, see at www. hiltonvancouver.com, expires Aug. 30, '04, $150/obo. 714/996-9334, Steve.

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